

RECLAMATION

Managing Water in the West

Survey of Fish and Plant Species in Arch Wetland and Arkansas River at Bent's Old Fort National Historic Site Otero County, Colorado



**U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, Colorado**

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Survey of Fish and Plant Species in Arch Wetland and Arkansas River at Bent's Old Fort National Historic Site

Otero County, Colorado

submitted to

National Park Service

prepared by

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Summary

During September 2005, the Bureau of Reclamation conducted an inventory of the fish species in the Arch Wetland and in the Arkansas River within the boundaries of Bent's Old Fort National Historic Site (BEOL) in Otero County, Colorado. An inventory of plant species was also conducted at the Arch Wetland during September 2005 and May 2006. Both of these inventories were part of an effort to identify any species of concern or additional species occurrences. A secondary objective of the fish sampling was to document the presence of individuals or habitat of the state-threatened Arkansas darter (*Etheostoma cragini*).

A total of 12 fish species were detected at BEOL, including 8 new species records for the park. The park now has a total of 13 fish species detected within the park. In this study, 3 fish species were documented in the Arch Wetland, and 9 fish species were documented in the Arkansas River. The flathead chub (*Hybopsis gracilis*) is the only species of conservation concern (a state species of concern in Colorado) detected within the park. The exotic species that are present, mosquitofish (*Gambusia affinis*) and bluegill (*Lepomis macrochirus*), do not cause an immediate threat to the native species, due to the health of the native populations. No Arkansas darters were found in either the wetland or the river. The available habitat for the Arkansas darter in the Arch Wetland is highly unsuitable, and the habitat in the Arkansas River is marginally suitable. The documented species are typical of what is expected to be present in the Arkansas River. A few less common species were not captured, but are presumed to be present.

A total of 82 plant species were documented in and around the Arch Wetland, including 18 species that were new records for the park. None of the recorded species are listed as threatened or endangered or tracked by the Colorado Natural Heritage Program. The new species detected appeared to be primarily common weedy species or cultured ornamentals. The overall health of the plant community in and around the Arch Wetland appears to be fair, with some limitations regarding the abundance of exotic cattails (*Typha angustifolia*) and Canada thistle (*Cirsium arvense*). The diversity and abundance of both plant and fish species at the Arch Wetland would improve with an aggressive exotic plant control program.

During the fish and plant surveys, there were incidental observations of 4 herp species. At the Arch Wetland, a bullfrog (*Rana catesbeiana*) and a garter snake (*Thamnophis* sp.) were recorded. Along the banks of the Arkansas River, several leopard frogs (*Rana pipiens*) and a northern water snake (*Nerodia sipedon*) were observed.

Introduction

Bent's Old Fort National Historic Site (BEOL) is a 799-acre park located in Otero County, in southeastern Colorado. The park is primarily shortgrass prairie with the Arkansas River bisecting the park and several wetland areas dispersed throughout the park.

The Arch Wetland is a 55-acre palustrine wetland that park natural resource staff has identified as one of the park's key natural resources. It is semi-permanently flooded, and is covered by a dense (approximately 95%), homogenous stand of cattails (*Typha latifolia*). The scarce open water areas have very deep, mucky anaerobic substrate. The water inflow is from bank overflow from the Arkansas River and irrigation water leakage from Fort Lyon Canal. The wetland has high flood attenuation and storage capability due to the dense vegetative cover and restricted outlet and its occurrence within the floodplain of the Arkansas River. Upstream alterations in hydrology (dams, diversions, channelization, etc.) have drastically affected the natural flooding cycle of the Arkansas River.

The Colorado Natural Heritage Program conducted surveys for fish and plants at the Arch Wetland during low-water conditions in 2001 (Gionfriddo et al. 2002). Additional information is needed in order to evaluate the wetland for potential ecological indicators to incorporate into a long-term monitoring plan (CDOW 2004).

Fish Sampling

The primary objectives of fish sampling at Arch Wetland and in the Arkansas River at BEOL was to determine the presence of the Colorado-threatened Arkansas darter and/or its habitat and add any new species for the park. The Arkansas darter prefers shallow, clear, sandy streams with abundant rooted aquatic vegetation. The available habitat in the Arkansas River is more similar to the ideal habitat of Arkansas darters than that in the Arch Wetland. Therefore, it was decided to conduct a more intensive trapping effort in the river than in the wetland.

Methods

Field sampling for fish species was conducted from September 12th through the 15th, 2005. A total of fifteen minnow traps were set up at BEOL, 5 in the Arch Wetland and 10 in the Arkansas River (Fig. 1). The location of each fish trap was recorded on a Garmin 12 GPS (Global Positioning System) unit and was recorded as latitude/longitude coordinates. All coordinates were collected in the North American Datum of 1983 (NAD83). The lat/long locations of the traps are listed in Table 1. These traps were maintained and checked twice daily over 70 consecutive hours, for a survey effort of 1050 trap-hours. The survey effort in the Arch Wetland was 350 trap-hours, and 700 trap-hours in the Arkansas River.

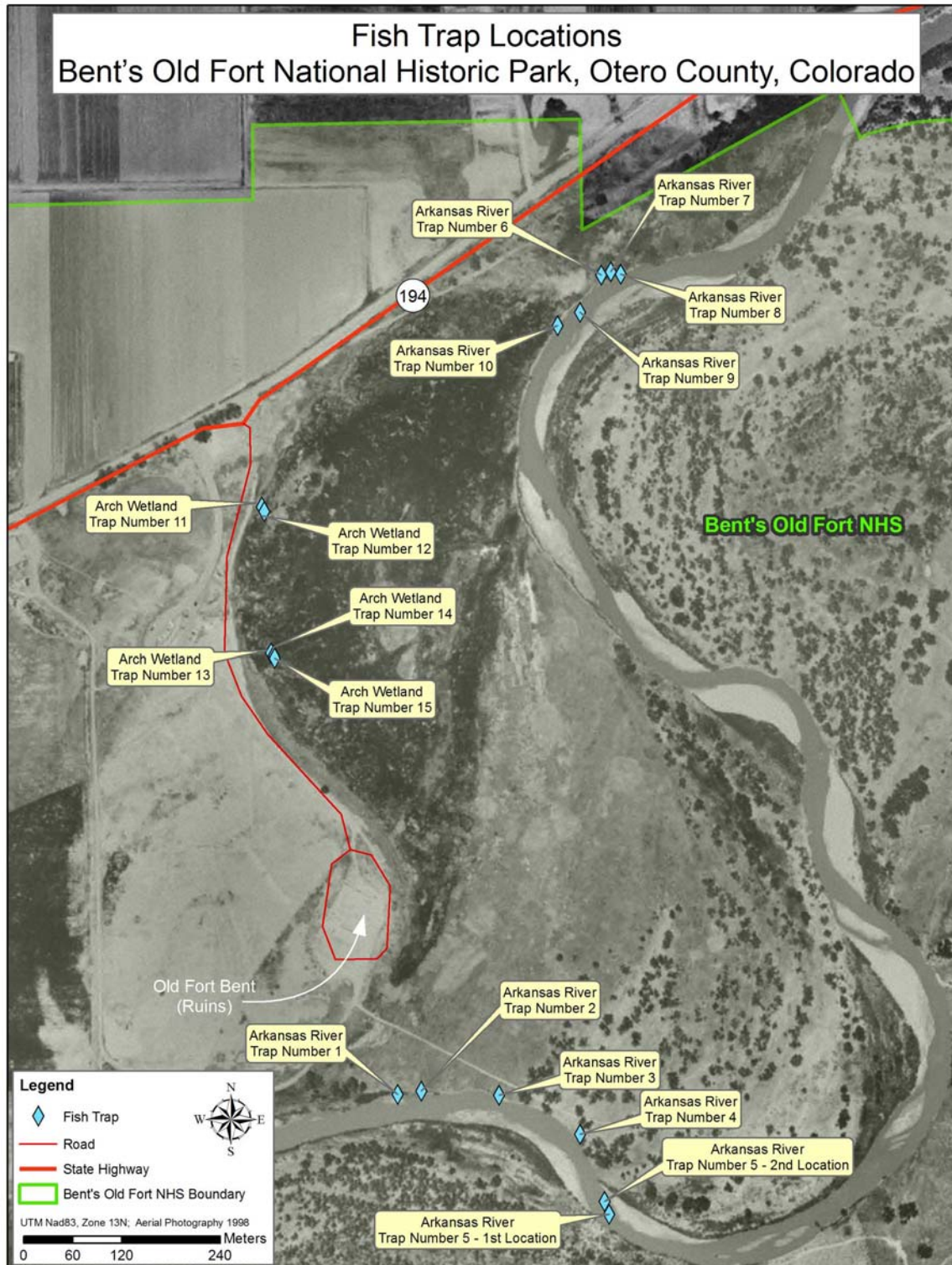


Figure 1. Locations of fish traps within Bent's Fort National Historic Site.

In the Arkansas River, 10 minnow traps were placed in at least 1 foot deep water close to the riverbank, and usually under overhanging vegetation. The traps were baited with canned cat food and crackers, and anchored by rope to the riverbank. They were checked morning and afternoon, and all species captured were recorded and released unharmed at the capture locations. One trap was moved to a different location mid-way through the trapping period, in an effort to maximize the diversity of fish species captured.

In the Arch Wetland, 5 traps were placed in at least 1 foot deep water close to dense cattails. Traps were baited with canned cat food and crackers, and anchored by rope to cattails. They were checked morning and afternoon, and all species captured were recorded and released unharmed at the capture locations.

In the Arkansas River, fish were also sampled by dip netting and seine netting. A total of 6 pulls with the seine net and several dips with the dip nets were conducted in the river. In the Arch Wetland, the conditions were not conducive to effective seine netting, so fish were sampled via the minnow traps and some dip netting. All captured fish species were identified and recorded and released unharmed at the capture locations.

Table 1. Individual trap locations on Bent's Old Fort National Historic Park, Otero County, Colorado.

Trap Number	Location	N	W
1	Arkansas River	38°02'18.7"	103°25'44.2"
2	Arkansas River	38°02'18.8"	103°25'43.0"
3	Arkansas River	38°02'18.6"	103°25'39.1"
4	Arkansas River	38°02'17.0"	103°25'35.1"
5-1 st location	Arkansas River	38°02'13.8"	103°25'33.7"
5-2 nd location	Arkansas River	38°02'14.3"	103°25'33.9"
6	Arkansas River	38°02'51.1"	103°25'33.3"
7	Arkansas River	38°02'51.2"	103°25'32.8"
8	Arkansas River	38°02'51.1"	103°25'32.3"
9	Arkansas River	38°02'49.6"	103°25'34.4"
10	Arkansas River	38°02'49.1"	103°25'35.5"
11	Arch Wetland	38°02'42.1"	103°25'50.5"
12	Arch Wetland	38°02'41.9"	103°25'50.4"
13	Arch Wetland	38°02'36.3"	103°25'50.2"
14	Arch Wetland	38°02'36.2"	103°25'50.0"
15	Arch Wetland	38°02'36.1"	103°25'50.0"

Results and Discussion

The habitat available for fish in the Arch Wetland is significantly different from the fish habitat in the Arkansas River. Of the 12 species that have been detected at the park in this study and Gionfriddo et al. (2002), only one species (mosquitofish) was detected in both the Arkansas River and the Arch Wetland. Of the five species detected in the Arch Wetland between this study and Gionfriddo et al. (2002), all were reported as being present in the Arkansas River by Nesler et al. (1999) who studied a reach that extended beyond the park boundaries. The reach of Arkansas River at the park is shallow, clear, and has a sandy/gravelly substrate, with very little aquatic vegetation growing in the riverbed. The Arch Wetland is deeper, with a very deep, anaerobic detritus substrate that causes the water to become very turbid when disturbed. It is possible that fish species occurring in the Arkansas River may reach the Arch Wetland during flood events, when the river flow overtops its banks. It is not currently known if such flood events have led to the successful establishment of breeding populations of fish in the Arch Wetland.

The Arkansas darter is listed as threatened in Colorado and is a candidate for protection under the federal Endangered Species Act. No Arkansas darters were found in either the Arch Wetland or the Arkansas River within the boundaries of BEOL. The darter prefers habitat in shallow, clear streams with sandy substrate and abundant emergent vegetation. The only apparent darter habitat component missing from the Arkansas River at this site is the lack of in-river emergent vegetation. Emergent vegetation would also benefit native stonerollers (*Camptostoma anomalum*) and plains killifish (*Fundulus zebrinus*), however efforts to increase emergent vegetation would be extremely time and labor-intensive in the managed Arkansas River. A moderate amount of vegetation exists along the riverbanks, but the bed is somewhat channelized, so very little vegetation exists within the riverbed. The closest known record of Arkansas darter in recent years was located at least 50 miles downstream, in a small tributary off the main river (Nesler et al. 1999). The water in the Arch Wetland is not flowing, and can be clear if the substrate is not disturbed. We consider the habitat in the wetland to be highly unsuitable for Arkansas darters due to the lack of flow and the anaerobic substrate.

Three species of fish were recorded in the Arch Wetland (Table 2). Brook stickleback (*Culaea inconstans*) and plains killifish were captured in the traps, and mosquitofish (*Gambusia affinis*) were captured in the dip nets. Interestingly, we did not detect two fish species (common carp [*Cyprinus carpio*] and green sunfish [*Lepomis cyanellus*]) detected at the wetland by Gionfriddo et al. (2002). Additional species of fish may have been present in the Arch Wetland, and avoided the traps and dip nets. Nesler et al. (1999) felt that the southern redbelly dace may also be found in this warmwater habitat, but would not be abundant. Due to the paucity of the habitat for fish in the Arch Wetland, we feel that this sample of fish is representative of the diversity of fish species in the Arch Wetland.

In the Arkansas River, nine species of fish were recorded (Table 2). Sand shiner (*Notropis stramineus*), red shiner (*Notropis lutrensis*), bluegill (*Lepomis macrochirus*), bullhead catfish (*Ameiurus* sp.), channel catfish (*Ictalurus punctatus*), suckermouth

minnow (*Phenacobius mirabilis*), fathead minnow (*Pimephales promelas*), and flathead chub (*Hybopsis gracilis*) were the species captured in the minnow traps. Only mosquitofish, sand shiners, and red shiners were captured in the seine and dip nets. Flathead chub is a state species of concern in Colorado. Nesler et al. (1999) did not detect suckermouth minnow in this reach of the Arkansas River, but did detect 13 species that were not detected in this study: stoneroller, plains killifish, green sunfish (*Lepomis cyanellus*), white sucker (*Catostomus commersonii*), gizzard shad (*Dorosoma cepedianum*), orangespotted sunfish (*Lepomis humilis*), carp (*Cyprinus carpio*), saugeye (*Sander vitreus x Sander canadense*), white crappie (*Pomoxis annularis*), longnose sucker (*Catostomus catostomus*), black crappie (*Pomoxis nigromaculatus*), largemouth bass (*Micropterus salmoides*), and yellow perch (*Perca flavescens*).

It is likely that additional species are present in the Arkansas River, and did not get captured in the traps or nets. We feel that this sample of fish species is an adequate representation of the fish species diversity in the river, though additional, less common species are likely to occur. Species common to this habitat that may have been present but not captured include the stoneroller, white sucker, and longnose sucker. The stoneroller is not tolerant of organically enriched waters that may be present due to upstream agricultural drainage (Woodling 1985).

Table 2. Species captured in Arch Wetland and Arkansas River, and estimate of abundance. The Estimate of Abundance (Abundant, Common, Uncommon, Rare) is based strictly on the proportion of species captured in our trapping and netting efforts. This abundance estimate may not represent the actual species' abundance in the Arch Wetland or Arkansas River.

Species Captured	Estimate of Abundance
Arch Wetland	
Mosquitofish (<i>Gambusia affinis</i>)	Abundant
Brook stickleback (<i>Culaea inconstans</i>)	Common
Plains killifish (<i>Fundulus zebrinus</i>)	Uncommon
Arkansas River	
Mosquitofish (<i>Gambusia affinis</i>)	Abundant
Sand shiner (<i>Notropis stramineus</i>)	Abundant
Red shiner (<i>Notropis lutrensis</i>)	Common
Bullhead catfish (<i>Ameiurus</i> sp.)	Uncommon
Channel catfish (<i>Ictalurus punctatus</i>)	Common
Fathead minnow (<i>Pimephales promelas</i>)	Uncommon
Bluegill (<i>Lepomis macrochirus</i>)	Rare
Suckermouth minnow (<i>Phenacobius mirabilis</i>)	Rare
Flathead chub (<i>Hybopsis gracilis</i>)	Rare

Plant Sampling

The objective of plant sampling at the Arch Wetland was to document any plant species that had not been previously recorded.

Methods

From September 12th through the 15th, 2005, the area in and around Arch Wetland was inspected for the purpose of identifying plant species, for a cumulative survey period of approximately 8 hours. Another 8 hours of plant surveys were conducted on May 31, 2006, with the expectation of finding additional species in different stages of flowering.

Plant searches were conducted by systematically identifying individual plants. Plant collection was limited to those species difficult to identify in the field, for later identification, and new species for herbarium specimens, if ample quality specimens were available. The Arch Wetland and additional perimeter areas, from the wetland north to U.S. Highway 194, the area east and south of the wetland to the river, and the area to the west and southwest of the Arch Wetland to the entrance road and the fort, respectively, were systematically searched and plants were identified and collected.

Results and Discussion

Sixty-four plant species were recorded that were already listed on the BEOL Plant Checklist (Table 3). Eighteen plant species were identified that could not be found on the provided species lists for BEOL (Table 4). However, many of these are common weedy species or appeared to be planted ornamentals. Four of the 18 plant species not on the species list were located along the walking path to Bent's Fort and appeared to be cultured for the fort visitors. These were cholla cactus (*Cylindropuntia imbricate*), pinon pine (*Pinus edulis*), starvation cactus (*Opuntia polyacantha*) and yucca (*Yucca glauca*). Four new weedy species were found: cocklebur (*Xanthium strumarium*), Russian olive (*Elaeagnaceae angustifolia*), spiny sowthistle (*Sonchus oleraceus*), and Chinese elm (*Ulmus pumila*). Seven new plant species were found within the wetlands, although none were common and most well hidden within the cattails. These were: yellow nutsedge (*Cyperus esculentus*), duckweed (*Lemna minor*), field mint (*Menta arvensis*), garden parsnip (*Pastinaca sativa*), Canada germander (*Teucrium canadense* var. *occidentale*), watercress (*Nasturium officinale*), and Hornemann's willowherb (*Epilobium hornemannii*). A rye grass (*Lolium* sp.) was found near highway 194 and probably blew in from traffic using that road. A new species of coneflower was found (*Ratibida tagetes*). An asparagus (*Asparagus officinalis*) was found east of Arch Wetland.

Table 3. Plant species found in or around Arch Wetland that were already on Bent's Old Fort Plant Checklist.

Ragweed	Native	<i>Ambrosia psilostachya</i>
Indian hemp	Native	<i>Apocynum cannabinum</i>
Sand sage	Native	<i>Artemisia filifolia</i>
Showy milkweed	Native	<i>Asclepias speciosa</i>
Whorled milkweed	Native	<i>Asclepias subverticillata</i>
Locoweed	Native	<i>Astragalus bisulcatus</i>
Four-wing saltbush	Native	<i>Atriplex canescens</i>
Groundsel tree	Native	<i>Baccharis salicina</i>
Kochia	Exotic	<i>Bassia sieversiana</i>
Side-oats gramma	Native	<i>Bouteloua curtipendula</i>
Blackcreeper sedge	Native	<i>Carex praeegracilis</i>
Sandbur	Native	<i>Cenchrus longispinus</i>
Lambsquarters	Native	<i>Chenopodium berlanderi</i>
Windmillgrass	Native	<i>Chloris verticillata</i>
Blue gramma	Native	<i>Chondrosum gracile</i>
Rabbitbrush	Native	<i>Chrysothamnus nauseosus</i>
Canada thistle	Exotic	<i>Cirsium arvense</i>
Virgin's bower	Native	<i>Clematis ligusticifolia</i>
Bindweed	Exotic	<i>Convolvulus arvensis</i>
Horseweed	Native	<i>Conyza canadensis</i>
Foxtail barley	Native	<i>Critesion jubatum</i>
Coyote melon	Native	<i>Cucurbita foetidissima</i>
Teasel	Exotic	<i>Dipsacus sylvestris</i>
Saltgrass	Native	<i>Distichlis spicata stricta</i>
Barnyard grass	Exotic	<i>Echinochloa crusgalli</i>
Canada wild rye	Native	<i>Elymus canadensis</i>
Green ash	Exotic	<i>Fraxinus pennsylvanica</i>
Velvety gaura	Native	<i>Gaura parviflora</i>
Wild licorice	Native	<i>Glycyrrhiza lepidata</i>
Gumweed, rosenweed	Native	<i>Grindelia squarrosa</i>
Broom snakeweed	Native	<i>Gutierrezia sarothrae</i>
Common sunflower	Native	<i>Helianthus annuus</i>
Bush morning glory	Native	<i>Ipomoea leptophylla</i>
Winter fat	Native	<i>Krascheninnikova lanata</i>
Duckweed	Native	<i>Lemna minor</i>
Tall white mustard	Native	<i>Lepidium latifolium</i>
Tansy aster	Native	<i>Machaeranthera phyllocephala</i>
Alkali muhly	Native	<i>Muhlenbergia asperifolia</i>
Evening primrose	Native	<i>Oenothera villosa villosa</i>
Witchgrass	Native	<i>Panicum capillare</i>
Vine-mesquite	Native	<i>Panicum obtusum</i>
Virginia creeper	Native	<i>Parthenocissus vitacea</i>
Reed canary grass	Native	<i>Phalaris arundinacea</i>

common reed, rivergrass	Native	<i>Phragmites australis</i>
Virginia Groundcherry	Native	<i>Physalis virginiana</i>
Knotweed	Native	<i>Polygonum areastrum</i>
Smartweed	Native	<i>Polygonum ramosissimum</i>
Plains cottonwood	Native	<i>Populus sargentii</i>
Curly dock	Exotic	<i>Rumex crispus</i>
Peach leaved willow	Native	<i>Salix amygdaloides</i>
Sandbar willow	Native	<i>Salix exigua</i>
Russian thistle	Exotic	<i>Salsola iberica</i>
Hardstem bulrush	Native	<i>Schoenoplectus lacustris acutus</i>
Common three square	Native	<i>Schoenoplectus pungens</i>
Alkali bulrush	Native	<i>Scirpus paludossus</i>
Johnson grass	Exotic	<i>Sorghum halepense</i>
Prairie cordgrass	Native	<i>Spartina pectinata</i>
Copper mallow	Native	<i>Sphaeralcea coccinea</i>
Needle-and-thread grass	Native	<i>Stipa comata</i>
Tamarisk, salt cedar	Exotic	<i>Tamarix ramosissima</i>
Pennycress	Exotic	<i>Thlaspi arvense</i>
Puncture vine	Exotic	<i>Tribulus terrestris</i>
Narrow leaved cattail	Native	<i>Typha angustifolia</i>
Speedwell	Native	<i>Veronica anagallis-aquatica</i>

Table 4. Plant species encountered near the Arch Wetland that were not on the Bent's Old Fort Plant Checklist.

Species	Native/Exotic	Location
Asparagus sp. (<i>Asparagus officinalis</i>)	Exotic	East side of wetlands near the river
Cholla cactus (<i>Cylindropuntia imbricate</i>)	Native	Near restroom
Yellow nutsedge (<i>Cyperus esculentus</i>)	Exotic	Arch Wetland
Russian olive (<i>Elaeagnaceae angustifolia</i>)	Exotic	East side of wetlands near the river
Hornemann's willowherb (<i>Epilobium hornemannii</i>)	Native	Arch Wetland
Common duckweed (<i>Lemna minor</i>)	unknown	Arch Wetland
Ryegrass (<i>Lolium sp.</i>)*	Native	Close to Hwy 194
Field mint (<i>Menta arvensis</i>)	Native	Arch Wetland
Watercress (<i>Nasturium officinale</i>)	Exotic	Arch Wetland
Starvation cactus (<i>Opuntia polyacantha</i>)	Native	Along the walkway to the fort
Common Garden parsnip (<i>Pastinaca sativa</i>)	Native	Arch Wetland
Piñon pine (<i>Pinus edulis</i>)	Native	Near restroom

Prairie coneflower (<i>Ratibida tagetes</i>)	Native	East side of wetlands near the river
Spiny sowthistle (<i>Sonchus asper</i>)	Exotic	East side of wetlands near the river
Canada Germander (<i>Teucrium canadense</i> var. <i>occidentale</i>)	Native	East side of wetlands near the river
Chinese elm (<i>Ulmus pumila</i>)	Exotic	East side of wetlands near the river
Common cocklebur (<i>Xanthium strumarium</i>)	Native	East side of wetlands near the river
Yucca (<i>Yucca glauca</i>)	Native	Along the walkway to the fort

* Those plants that were identified only to genus should be identifiable to species if they are found and collected during flowering.

Cattail (*Typha latifolia*) encroachment of the Arch Wetland is of particular concern. It appears that cattails comprise more than 90% of the watered area of the wetlands and at least 70% of the wet soil area around the wetland. The open water areas of the wetland are few and water depth is around 18 inches. Information received on the BEOL wetlands prior to our visit indicates that cattail was a newly vouchered specimen during 2001 evaluations. Cattails are an aggressive species and provide less quality habitat than the two bulrush species identified at the Arch Wetland (hardstem bulrush, *Schoenoplectus lacustris acutus*; and alkali bulrush, *S. paludossus*). Cattails can easily grow in water depths up to four feet. If open water areas are to remain open, it is recommended that an integrated pest management program be initiated as soon as possible. If natural succession of the wetlands is allowed to take place, it is assumed that cattails will fill in all of the open water areas within the next two years.

Canada thistle (*Cirsium arvense*) is a severe problem around the perimeter of the Arch Wetland and forms a monoculture in several areas, restricting riparian plant species diversity. Personnel at BEOL are pursuing an active mowing and spraying program. We encourage these as well as other efforts, so that the problem does not become uncontrollable.

Four new weedy species were found during surveys that were not already recorded on the existing species list. Currently, these are not numerous and could be controlled easily with herbicides.

The overall health of the plant community in and around the Arch Wetland appears to be fair, with these limitations:

- 1) the monoculture stands of cattails and Canada thistle
- 2) the shallow depth of the open water areas within the wetlands
- 3) the possible anaerobic conditions that may exist within the wetlands.

Suggestions for Future Studies

The open water areas of the Arch Wetland are not navigable on foot. This makes seine netting in the Arch Wetland impossible, and dip netting very localized. Electroshocking in the Arch Wetland would be impractical, based on the inaccessibility for a larger boat and the thick emergent vegetation. Future fish surveys in the wetland should include a canoe or small inflatable raft in which to navigate the open water areas. Fish traps could be placed throughout the open water areas if a small boat was utilized to gain access. We could not locate a boat for this purpose during this study.

Fish surveys in the Arkansas River may produce different results if conducted during different times of year. During our study, the river was quite low, and different species in different proportions may be captured during the higher flow seasons. A potential ecological indicator to the health of the overall ecosystem in both the Arch Wetland and the Arkansas River may be water quality and invertebrate diversity and abundance. Water quality monitoring may reveal potential limitations for the presence of additional fish and plant species. Invertebrates will respond quickly to changes in water quality, predicting changes in fish diversity and abundance.

The plant surveys may be more efficient if conducted during the late spring, when most plants are flowering and easier to identify.

Control of both the cattails and the Canada thistle should be undertaken and it appeared that personnel at BEOL are aware of the problems these two species can cause and that efforts are currently underway to control the Canada thistle and perhaps the cattails as well. Bulrushes could be cultured along the river and at some of the other wetlands within BEOL. This effort could provide extra fish habitat along the river and also provide nursery stock for the Arch Wetland, if an aggressive cattail control program is started. The large populations of cattails and Canada thistle at BEOL also show good potential for herbicide trials.

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